1   **Communication Apparatus for Selecting a**

Communication Protocol Compatible to a Partner

Station and Executing the Selected Protocol

5   **BACKGROUND OF THE INVENTION**

Field of the Invention

The present invention relates to a communication

apparatus which selects a communication protocol

compatible to a partner station and executing the

10   selected protocol.

Related Background Art

In prior art apparatus of this type, a facsimile

apparatus is known. The communication protocol

of the facsimile apparatus includes G1, G2, G3 and G4

15   protocols. The G4 protocol uses a digital line and

the G1, G2 and G3 protocols use an analog public line.

In connecting a line to a communication partner station,

the facsimile apparatus sequentially sends the G3

protocol, the G2 protocol and the G1 protocol and

20   determines which protocol is to be executed in

accordance with the presence or absence of acknowledge

signals to the respective sent signals.

However, in the above facsimile apparatus, the

G3 protocol, the G2 protocol and the G1 protocol are

25   sequentially sent and the presence or absence of the

acknowledge signal thereto is checked. Accordingly, a

long time is required before the communication protocol

1   to be executed is determined.

When a new communication protocol is added to
the above protocols, a longer time is required before
the communication protocol is determined. Where

5   signals are to be sent and received to and from the
partner station, if the reception of the signal is
unsuccessful, a protocol of a lower function is
selected even if the partner station actually has a
protocol of a higher function.

10   Information on the communication function of
the partner station may be registered, together with
a telephone number of the partner station, in a one-
touch dial key or an abbreviated dial key. Thus, when
a call is made by depressing the dial key, the

15   communication mode is selected in accordance with the
registered information of the communication function
(USP 4,910,506).

However, in the above USP 4,910,506, the
information of the communication function registered

20   in the one touch key is not useful for a received call.

SUMMARY OF THE INVENTION

It is an object of the present invention to
provide an improved communication apparatus in the

25   light of the above problems.

It is another object of the present invention
to provide a communication apparatus which can rapidly

determine a proper communication protocol at the

reception of a call in accordance with a partner or

calling station.

Other objects of the present invention will

be apparent from the following detailed description

and drawings of the preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is composed of Figs. 1A and 1B and

is a block diagram of a configuration of a facsimile

apparatus according to the invention;

Fig. 2 is a flow chart of the control steps of a

control circuit 54 of Fig. 1B,

Fig. 3 is a flow chart of the control steps of the

control circuit 54 of Fig. 1B,

Fig. 4 is a flow chart of the control steps of the

control circuit 54 of Fig. 1B,

Fig. 5 is a flow chart of the control steps of the

control circuit 54 of Fig. 1B;

Fig. 6 is a flow chart of the control steps of the

control circuit 54 of Fig. 1B,

Fig. 7 is a flow chart of the control steps of the

control circuit 54 of Fig. 1B, and

Fig. 8 is a flow chart of the control steps of the

control circuit 54 of Fig. 1B.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

1 [Embodiment 1]

Figs. 1A and 1B comprise a block diagram of an
embodiment of a facsimile apparatus of the present
invention.

5 In Figs. 1A and 1B, numeral 2 denotes a CML
relay which connects a telephone line (signal lines 2a,
2b) to a facsimile communication unit (signal lines
14a, 14b) when a signal level '1' is outputted to a
signal line 54a, and connects the telephone line

10 (signal lines 2a, 2b) to a telephone set (signal lines
10a, 10b) when a signal level '0' is outputted to the
signal line 54a.

Numeral 4 denotes a TEL relay for detecting
non-ringing call reception and an off-hook state during

15 communication. It connects signal lines 6a, 6b to the
signal lines 10a, 10b when the signal level '1' is
outputted to a signal line 54b, and connects the signal
lines 6a, 6b to signal lines 8a, 8b when the signal
level '0' is outputted to the signal line 54b. When

20 the signal level '0' is outputted to the signal line
54b, an off-hook detection circuit 8 determines
whether the telephone set is in the off-hook state or
not, and if it is in the off-hook state, it outputs the
signal level '0' to a signal line 8c.

25 Numeral 6 denotes a telephone set.

Numeral 10 denotes a call signal detection
circuit which receives the signals on the signal lines

1   10a and 10b, and outputs the signal level '1' to the

signal line 10a when it detects a call signal and

outputs the signal level '0' to the signal line 10a

when it does not detect the call signal.

5   Numeral 12 denotes a circuit for detecting

telephone number information sent between the call

signals. It outputs the detected telephone number

information to a signal line 12a.

        Numeral 14 denotes a hybrid circuit for

10   separating a transmission signal from a reception

signal. Namely, the transmission signal on a signal

line 30a is sent to the telephone line through signal

lines 14a, 14b and the CML relay 2. A signal sent

from the other station is outputted to a signal line 14c

15   through the CML relay 2 and the signal lines 14a, 14b.

        Numeral 16 denotes a modulator for modulating

a signal in accordance with the CCITT Recommendation

V.21. The modulator 16 receives a protocol signal on

a signal line 54c, modulates it and outputs the

20   modulated data to a signal line 16a.

        Numeral 18 denotes a modulator for modulating

a signal in accordance with the CCITT Recommendation

V.8. The modulator 18 receives a protocol signal on a

signal line 54d, modulates it and outputs the modulated

25   data to a signal line 18a.

        Numeral 20 denotes a Q·PSK modulator for a

protocol between image transmission pages by using a

1 V.34 high speed modem. The modulator 20 receives a protocol signal on the signal line 54e, modulates it and outputs the modulated data to a signal line 20a.

Numeral 22 denotes a read circuit which
5 sequentially reads one line of image signal along a main scan direction from a transmission document sheet to generate a signal train representing black and white binary signals. It comprises an image pickup device such as a CCD (charge coupled device) and an
10 optical system. The black and white binary signal train is outputted to a signal line 22a.

Numeral 24 denotes an encoder which receives the read data outputted to the signal line 22a and outputs encoded data (MH (modified Huffmann) encoded,
15 MR (modified READ) encoded or MMR (modified modified READ) encoded data) to a signal line 24a.

Numeral 26 denotes a modulator which modulates a signal in accordance with the known CCITT Recommendation V.27 ter (differential phase modulation),
20 V.29 (quadrature modulation) or V.17. The modulator 26 receives the signal on the signal line 24a when the signal level '1' is outputted to a signal line 54f, modulates it and outputs the modulated data to a signal line 26a. The modulator 26 does nothing when the
25 signal level '0' is outputted to the signal line 54f.

Numeral 28 denotes a modulator which modulates a signal in accordance with the CCITT Recommendation

1   V.34. When the signal level '1' is outputted to a

signal line 54g, the modulator 28 receives the signal

on the signal line 24a, modulates it and outputs the

modulated data to a signal line 28a. The modulator 28

5   does nothing when the signal level '0' is outputted to

the signal line 54g.

     Numeral 30 denotes an adder circuit which

receives the signals on the signal lines 16a, 18a, 20a,

26a and 28a and outputs a sum signal to a signal line

10   30a.

     Numeral 32 denotes a demodulator which

demodulates a signal in accordance with the known

CCITT Recommendation V.21. The demodulator 32 receives

the signal on a signal line 14c, demodulates it and

15   outputs the demodulated data to a signal line 32a.

     Numeral 34 denotes a demodulator which

demodulates a signal in accordance with the CCITT

Recommendation V.8. The demodulator 34 receives the

signal on the signal line 14c, demodulates it and

20   outputs the demodulated data to a signal line 34a.

     Numeral 36 denotes a Q·PSK demodulator for the

protocol between image transmission pages using the

CCITT Recommendation V.34 high speed modem. The

demodulator 36 receives the signal on the signal line

25   14c, Q·PSK demodulates it and outputs the demodulated

data to a signal line 36a.

     Numeral 38 denotes a demodulator which

1   demodulates a signal in accordance with the known

CCITT Recommendation V.27 ter (phase difference

modulation), V.29 (quadrature modulation) or V.17.

The demodulator 38 receives the signal on the signal

5   line 14c, demodulates it and outputs the demodulated

data to a signal line 38a.

       Numeral 40 denotes a demodulator which

demodulates a signal in accordance with the CCITT

Recommendation V.34. The demodulator 40 receives the

10   signal on the signal line 14c, demodulates it and

outputs the demodulated data to a signal line 40a.

       Numeral 42 denotes a decoder circuit which

receives the signal outputted to the signal line 38a

when the signal level '0' is outputted to a signal

15   line 54h, receives the signal outputted to the signal

line 40a when the signal level '1' is outputted to the

signal line 54h, and outputs encoded data (MH

(modified Huffmann) encoded, MR (modified READ)

encoded or MMR (modified modified READ) encoded data)

20   to a signal line 42a.

       Numeral 44 denotes a record circuit which

receives the data outputted to the signal line 42a and

sequentially records it one line at a time.

       Numeral 46 denotes a circuit which stores

25   communication systems (particularly, the communication

systems in accordance with V.21, V.27 ter, V.29 and

V.17 or the communication systems in accordance with

1 V.8 and V.34) in association with a telephone number of

a transmit station (copartner or calling station) sent

between call signals.

Numeral 48 denotes a circuit which stores the

5 data of registration of the communication system

through a signal line 48a in association with the

telephone number of the calling station sent between

call signals.

Numeral 50 denotes a circuit which counts the

10 number of times of communication (reception) after the

registration of the communication system through a

signal line 50a in association with the telephone

number of the calling station sent between call

signals.

15 Numeral 52 denotes a console unit having a

registration button used to store the communication

system in association with the telephone number of the

calling station sent between call signals, a ten-key,

one-touch dial keys, abbreviation dial keys, a sent

20 key, a start key and other function keys. The

information corresponding to the depressed key is

outputted to a signal line 52a.

Numeral 54 denotes a control circuit which,

in the facsimile apparatus capable of detecting the

25 telephone number information sent between call signals,

has means for storing the information of the communication system for

the calling station in accordance with the telephone

1   number information and call signal detection means and

primarily controls the start of the communication by

the stored communication system in accordance with

the telephone number information sent between call

5   signals when the call signal is detected. The

communication systems may be the communication systems

based on V.21, V.27 ter, V.29 and V.17 or the communi-

cation systems based on V.8 and V.34.

Figs. 2 and 3 ~~show~~ are flow charts of the control

10 of the control circuit 54. The circuits 48 and 50 are

not used here.

In Fig. 2, a step S60 represents the start.

In a step S62, the signal level '0' is outputted

to the signal line 54a to turn of the CML relay 2, that

15 is, connect the signal lines 2a and 2b to the signal

lines 10a and 10b.

In a step S64, the signal level '0' is outputted

to the signal line 54b to turn off the TEL relay 4,

that is, connect the signal lines ~~5a~~ 6a and 6b to the

20 signal lines 8a and 8b.

In a step S66, the signal level '0' is outputted

to the signal line 54f to set a state which does not

use the V.27 ter, V.29 or V.17 modulator 26.

In a step S68, the signal level '1' is outputted

25 to the signal line 54g to set a state which uses the

V.34 modulator 28.

In a step S70, the signal level '1' is outputted

1 to the signal line 54h to set a state in which decoder

circuit 42 receives the signal on the signal line 40a.

In a step S72, whether the registration of the

communication system in association with the telephone

5 number between call signals has been selected or not

is determined, and if the registration has been

selected, the process proceeds to a step S74 to

register the communication system (the first communi-

cation system based on V.21, V.27 ter, V.29 and V.17

10 or the second communication system based on V.8 and

V.34) in association with the telephone number of the

call signal to the circuit 46, and if the registration

has not been selected, the process proceeds to a step

S76.

15 In the step S76, the information on the signal

line 10a is received and whether the call signal has

been detected or not is determined. If the call

signal has been detected, the process proceeds to a

step S80, and if the call signal has not been detected,

20 the process proceeds to a step S78 to execute other

processes

~~process~~.

In the step S80, the information of the circuit

46 is checked to determine whether the telephone

number between call signals is for the first communi-

25 cation system based on V.21, V.27 ter, V.29 and V.17,

and if it is for the first communication system based

on V.21, V.27 ter, V.29 and V.17, the process proceeds

1   to a step S82, and if it is for the second communication

system based on V.8 and V.34, the process proceeds to

a step S96.

In the step S82, the signal level '1' is

5   outputted to the signal line 54f to set a state which

uses the V.27 ter, V.29 or V.17 modulator 26.

In the step S84, the signal level '0' is

outputted to the signal line 54g to set a state which

does not use the V.34 modulator 28.

10   In a step S86, the signal level '0' is

outputted to the signal line 54h to set a state in

which the decoder circuit 42 receives the information

on the signal line 38a.

In a step S88 of Fig. 3, the signal level '1'

15   is outputted to the signal line 54a to turn on the

CML relay 2.

A step S90 represents a pre-protocol based on

V.21.

A step S92 executes image transmission in

20   accordance with V.27 ter, V.29 or V.17.

A step S94 executes a post protocol based on

V.21.

In a step S96, the signal level '1' is outputted

to the signal line 54a to turn on the CML relay 2.

25   A step S98 executes a pre-protocol based on

V.8.

A step S100 executes image transmission in

1 accordance with V.34. A Q·PSK protocol is executed

between pages.

A step S102 executes a post protocol in

accordance with Q·PSK.

5 In accordance with the Embodiment 1, the

communication system of the calling station is stored

in the memory circuit 46 in association with the

telephone number between call signals which allows

the identification of the telephone number of the

10 calling station prior to the line connection, the

telephone number between call signals is detected

before the line connection, the communication system

of the calling station for the detected telephone

number is read from the memory circuit 46, the

15 communication system of its own apparatus is set to be

compatible to the communication system of the calling

station before the line connection, and the communi-

cation is started. Thus, in the apparatus having a

plurality of totally different communication systems

20 such as the communication system based on V.27 ter,

V.29 and V.17 and the communication system based on

V.34, the pre-protocol with the calling station can

be shortened and the communication cost can be reduced.

(In the apparatus having the totally different

25 communication systems, normally, the predetermined

pre-protocols are sequentially executed for each

communication system to detect the communication

1   system of the calling station, and the pre-protocol

time is long.)

Further, a chance to misrecognize the communi-

cation system of the calling station is reduced.

5   [Embodiment 2]

In the above embodiment, when the detected

telephone number between call signals is not registered

in the circuit 46, or when the telephone number is not

sent between call signals, the pre-protocol based on

10   V.8 may be executed and the image transmission by V.27

ter, V.29 or V.17 or the image transmission by V.34

may be determined in accordance with the ability of

the calling station.

A specific example of the above control is

15   shown in Fig. 4 for those portions which are different

from the flow charts of Figs. 2 and 3.

In the decision in the step S76 of Fig. 2 is

YES, the process proceeds to a step S112.

In the step S112, the information on the

20   signal line 12a is received and whether the telephone

number is present between call signals and the

detected telephone number is registered in the circuit

46 or not is determined. If YES, the process proceeds

to the step S80 of Fig. 2, and if NO, the process

25   proceeds to a step S116.

In a step S116, the signal level '1' is

outputted to the signal line 54a to turn on the CML

relay 2, that is, connect the signal lines 2a and 2b to the signal lines 14a and 14b.

A step S118 executes a pre-protocol based on V.8. The communication system of the calling station is determined based on the signal received in the V.8 pre-protocol.

In a step S120, whether the V.34 function is equipped or not is determined. If it is equipped, the process proceeds to the step S100 of Fig. 3 to execute the image transmission by V.34, and if it is not equipped, the process proceeds to the step S82 of Fig. 2.

In acccordance with the Embodiment 2, if the telephone number between call signals is not sent or the telephone number of the calling station is not registered, the communication by V.8 is executed so that the communication can be shifted to any communication system. Thus, a case in which the communication with the calling station is not established because the communication system is not identified before the line connection is avoided.

[Embodiment 3]

In the above embodiment, when a call is received from the telephone number between call signals for the first time, the communication may be executed by the communication system which allows any communication system because the mode of the calling

1 station is not known, and that communication system is
   information
   stored, and when a predetermined time is elapsed or a

   predetermined call reception circuit operates, the

   communication system is again determined for the same
            information

5 calling station and it is stored.

       A specific example of the above control is

   shown in Figs. 5 and 6 for those portions which are

   different from the flow charts of Figs. 2 and 3.

       When the decision in the step S76 of Fig. 2 is

10 YES, the process proceeds to a step S132.

       In the step S132, the information on the

   signal line 12a is received and whether the telephone

   number between call signals is sent or not is

   determined. If it is sent, the process proceeds to a

15 step S136, and if it is not sent, the process proceeds

   to the step S116 of Fig. 4.

       In the step S136, whether the telephone number

   between call signals is registered in the circuit 46

   or not is determined. If it is registered, the process

20 proceeds to a step S152, and if it is not registered,

   the process proceeds to a step S138.

       In the step S138, the signal level '1' is

   outputted to the signal line 54a to turn on the CML

   relay 2, that is, connect the signal lines 2a and 2b

25 to the signal lines 14a and 14b.

       A step S140 executes a pre-protocol based on

   V.8. In the V.8 pre-protocol, the communication

1 system of the calling station is determined.

In a step S142, whether the V.34 function is
equipped or not is determined, and if it is equipped,
the process proceeds to a step S144. If it is not
5 equipped, the process proceeds to a step S146.

In the step S144, the communication system by
V.8 or V.34 in association with the detected telephone
number between call signals is registered.

In the step S146, the communication system by
10 V.21, V.27 ter, V.29 or V.17 in association with the
detected telephone number between call signals is
registered in the circuit 46.

In a step S148, the date of registration in
association with the detected telephone number between
15 call signals is stored in the circuit 48 and a
reception counter in the circuit 50 is cleared. Then,
the process proceeds to the step S80 of Fig. 3.

In a step S152 of Fig. 6, the information in
the circuit 48 is read to determine whether the
20 telephone number between call signals has elapsed one
half year from the registration date or not. If it has,
the process proceeds to a step S138, and if it has not,
the process proceeds to a step S154.

In the step S154, the information in the
25 circuit 50 is read to determine whether the telephone
number between call signals has been received over 200
time or not. If it has, the process proceeds to a step

1 S138, and if it has not, the process proceeds to a step

S156.

In the step S156, the reception counter is

incremented by one in association with the detected

5 telephone number between call signals and it is

registered in the circuit 50. Then, the process

proceeds to the step S80 of Fig. 2.

The process proceeds from the step S70 of Fig.

2 to the step S76 of Fig. 2 and the steps S72 and S74

10 are not executed.

In accordance with the Embodiment 4, the

communication system by V.8 which permits the shift to

any communication system is set for the first communi-

cating calling station to prevent the occurrence of

15 communication error due to incompatibility of the

communication system with the calling station at the

first communication.

Further, since the communication system information which

resulted in the successful communication with the

20 calling station is stored in association with the

telephone number of the calling station, the communi-

cation system can be established before the line

connection at the next communication with that calling

station and the pre-protocol time is shortened and the

25 communication cost is reduced.

[Embodiment 4]

In the Embodiment 3, when calling is selected

1   for the telephone number information having the

communication system of the calling station stored in
information

association with the telephone number information

between call signals, that communication system may
information

5   be stored.

A specific example of the above control is

shown in Fig. 7 for those portions which are different

from the control flow charts of Figs. 5 and 6.

In the Embodiment 4, the process proceeds

10   from the step S78 of Fig. 2 to a step S166.

In the step S166, whether calling has been

selected or not is determined. If it is selected,
has been

the process proceeds to a step S168, and if it is not
has i ...

selected, the process proceeds to the step S62 of Fig.
been

15   2.

In the step S168, a designated station is

called.

In a step S170, the signal level '1' is

outputted to the signal line 54a to turn on the CML

20   relay 2.

In a step S172, whether the designated station

is registered in the circuit 46 or not is determined.

If it is registered, the process proceeds to a step

S174, and if it is not registered, the process

25   proceeds to a step S192.

The step S174 executes a pre-protocol. When

the V.8 pre-protocol signal from a called station is

1   to be detected, the V.8 pre-protocol is executed,

and when the V.21 protocol signal from the called

station is to be detected, the V.21 pre-protocol is

executed.

5   In a step S176, the image transmission is

executed. The image is transmitted by the communi-

cation system (V.27 ter, V.29. V.17 or V.34) determined

in the pre-protocol.

A step S178 executes a post protocol.

10   In a step S180, the signal level '0' is

outputted to the signal line 54a to turn off the CML

relay 2.

In a step S182, whether the image transmission

was by V.34 or not is determined, and if it was, the

15 process proceeds to a step S184, and if it was by V.27

ter, V.29 or V.17, the process proceeds to a step S186.

The step S184 is same as the step S144 of Fig.

5, the step S186 is same as the step S146 of Fig. 5,

and the step S188 is same as the step S148 of Fig. 5.

20 The process proceeds from the step S188 to the step

S62 of Fig. 2.

In accordance with the Embodiment 4, when the

call is made to the station registered in the circuit

46, the communication system information used for the communication

25 is stored in the circuit 46 in association with the

communicated station after the completion of the

communication. Thus, the content of the circuit 46 is

1 updated at the transmission and the calling station can

rapidly conform to the change of function by the

updating of the called station.

[Embodiment 5]

5   In the Embodiment 4, when the call is selected,

the communication system *information* may be stored even for the

telephone number information having the communication

system *information* of the called station not stored, in accordance

with the telephone number information between call

10 signals.

A specific example of the above control is

shown in Fig. 8 for those portions which are different

from the control flow chart of Fig. 7.

The process proceeds from the step S170 of Fig.

15 7 to a step S174.

In accordance with the Embodiment 5, when the

call is made to the station *having information* not stored in the circuit

46, the communication system *information* used in the communication

with the called station is stored in association with

20 the telephone number information of the called station

after the completion of the communication. Thus, once

called, the communication system *information* is automatically

stored in the circuit 46 and an operator time is saved.

In the embodiments described above, as the

25 communication system *information* (communication protocol) which is

previously stored in association with the telephone

number of the calling station received at the time of

1   reception of call, V.21, V.27 ter, V.29 and V.17 (G3

T.30 protocol) and V.8 and V.34 (high speed protocol)

have been discussed. However, the protocols to be

registered are not limited to those but the protocols

5   of G1, G2, G3, G4, V.8 and V.34 may be added, or the

communication protocols of teletex, telex and computer

communication in addition to the facsimile apparatus

may be added.

It should be understood that the present

10   invention is not limited to the above embodiments ~~but~~ and that

various modifications may be made.

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